

RESPONSIVENESS SUMMARY

Eagle Mine Groundwater Discharge Draft Permit GW1810162

The draft Groundwater Discharge Permit for the Eagle Mine, owned by Lundin Mining Corporation, was public noticed on December 3, 2013. In addition, a Public Hearing that included a Department of Environmental Quality (DEQ) presentation on the draft permit and a question and answer period, was held on March 25, 2014, at the Westwood High School in Ishpeming, Michigan.

The hearing was attended by 110 people that included residents, environmental groups, local government representatives, students and employees of the Eagle Mine. DEQ staff responded to many questions during the open session. Many more comments were received during the Public Hearing portion of the session. In addition, seven written comments were received during the extended public comment period which ended April 1, 2014.

A Groundwater Discharge permit may be contested within 60 days of issuance by filing a petition for Contested Case Hearing with the Michigan Administrative Hearing System within the Department of Licensing and Regulatory Affairs, c/o the Michigan Department of Environmental Quality. A petition may be obtained from the Internet at http://www.michigan.gov/deq/0,4561,7-135-3307_4157---,00.html.

Summary of Comments Received on the Draft Groundwater Discharge Permit

The following is a summary of comments received during the public notice period and from the public hearing. In preparing this summary, actual comment language was abbreviated, paraphrased, and/or edited for clarity. Following each comment is a response from DEQ Water Resources Division, Office of Oil, Gas and Minerals, and Air Quality Division staff.

Groundwater Concerns

- 1. Comments: Influent sampling should be required.**
Sampling of the influent with the same parameter list as required for the effluent is needed.

Response: The DEQ has decided to add influent sampling to the permit. Eagle Mine will be required to sample the influent to the Reverse Osmosis Units. The sampling parameters will be the same as the list for effluent sampling.

- 2. Comment:** We want strict, conservative, enforceable limits for discharge parameters. The permit should not authorize significant degradation of existing water quality.

Response: At the public hearing on March 25, the DEQ promised to determine which parameters would have limits, which would be monitoring only and provide a table showing what we decided. Here's some background.

The Eagle Mine permit contains both effluent and groundwater limits and/or monitoring requirements. Limits were set in the permit for each listed parameter based using the most restrictive limit when comparing groundwater discharge standards under Rule 2222 and surface water quality based effluent limits calculated under the Part 4, Water Quality Standards rules. In all cases, the limits contained in the permit are in compliance with Rule 2204 which specifies the requirements for all discharges to groundwater. These requirements include that all groundwater discharges must be consistent with the requirements of the Part 4 Rules and a prohibition against a discharge causing groundwater contamination in excess of the generic residential cleanup criteria established under Part 201, Environmental Remediation, of the NREPA. The table in Attachment I of this Responsiveness Summary identifies each substance and the basis for the limit.

Under the Part 22 Rules, limits may be set in either effluent or groundwater. In some cases, specific limits are set in the rules (total inorganic nitrogen and sulfate for example). In others, the limit is calculated in accordance with the rules. For most inorganic substances (most metals), the allowable limits are equal to a concentration of the substance half-way between the background groundwater quality and the generic residential cleanup criteria established under Part 201 of the NREPA. This requirement is specified in Rule 2222(5)(a). Most of the substances included in the Eagle Mine permit are limited under this rule. In accordance with the rule, these limits are set as groundwater limits rather effluent limits.

For surface water based limits, The Part 8 Rules, Promulgated pursuant to Part 31 of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended; dictate when limits (versus "report only") are required. The DEQ followed these rules in establishing limits that would protect the seeps to the Salmon Trout River at the venting location. Slight adjustments to the recommended effluent limits were made to account for advection and dispersion in groundwater from the point the effluent enters the TWIS to the venting location, a distance of over 3,000 feet. These adjustments were set at levels that would provide for compliance with the surface water quality standard at the point of venting. In a few cases (selenium, silver, arsenic and boron), the previous permit included maximum daily effluent limits based on groundwater standards. These limits were retained in the new permit.

To provide additional protection to both surface water and groundwater, the DEQ has required the permittee to notify the DEQ whenever their discharge exceeds five times the expected effluent quality (see Attachment 1). The DEQ can then require a number of actions, depending on the gravity of the discharge (see Part I. 9.d). This requirement is above and beyond the requirements contained in the Part 22 Rules.

While placing an effluent limit in the permit for each substance may add clarity and the advantage of increased enforceability, it would in many cases result in authorizing a discharge far above what is expected. We think the environment and public health are better protected by requiring the Eagle Mine to keep the discharge within five times the expected effluent quality than to have specific permit limits for every substance. Utilizing the provisions of Part 1, 8(d) of the permit provides for potential corrective actions well in advance of the discharge reaching the limit under the rules.

Aluminum is a good example:

Aluminum is report only in the effluent

The groundwater limit for Al is 150ug/l

There is no surface water limit

The expected effluent quality for Al is 1.9ug/l

The notification level (per Attachment I) is 9.5ug/l

With report only and a notification level of 9.5ug/l in the effluent, we are *more protective* than the groundwater standard.

It is also important to note that regardless of whether or not a limit is placed in the permit, the discharge must still be protective of both surface water and groundwater in accordance with the underlying requirements of Rule 2204. The permit achieves these requirements in all cases.

There are some exceptions to the general requirements discussed above. These exceptions are as follows:

Nitrogen is limited via groundwater limits for ammonia nitrogen and nitrate nitrogen set at the Part 201 generic residential cleanup criteria of 10 mg/l in accordance with Rule 2204(2)(f). This was done because the discharge to the TWIS receives no credit for treatment by soil or uptake by plants.

For some substances, the groundwater limit set in the permit was rounded to the nearest whole number. **Even with rounding, all groundwater based limits are in compliance with Rule 2204.**

Recent legislation enacted in Section 3109(e) of Part 31 has revised the effluent limits for sodium and chloride to 400 mg/l and 500 mg/l, respectively. The Part 201 clean up criteria still applies to groundwater with limits of 230 mg/l sodium and 250 mg/l chloride. If the discharge causes sodium or chloride to migrate off the property at levels greater than the Part 22 criteria, the permittee will be required to comply with the requirements of Section 3109(e) of Part 31. Therefore, report only is required in both the effluent and the groundwater.

In response to this comment, the DEQ has added an effluent limit for iron and groundwater limits for fluoride. The only substances remaining without specific limits are aluminum, phosphorus, nitrite and general water chemistry parameters which show overall groundwater quality (bicarbonate, calcium, potassium, magnesium and dissolved oxygen). The expected effluent concentration for phosphorus is 0.034 mg/l. The groundwater standard for phosphorus is more than 50 times greater than the expected effluent concentration. Nitrite is not expected to be measurable in the discharge.

3. **Comment:** What is the total annual groundwater discharge permit fee paid by the mine?

Response: The annual groundwater fee for a Rule 2218 permit is \$3,650.

4. **Comment:** Effluent sampling needs to be increased to a weekly basis.

Response: The DEQ will require weekly sampling of the effluent for all parameters except for pH and specific conductance, which require continuous sampling. The permittee may request a reduction in monitoring six months after the effective date of the permit. The monitoring frequency for parameters (other than mercury) shall not be reduced to less than monthly.

5. **Comment:** The measurement of specific conductance (and the development of the "Allowable Operating Range" for specific conductance levels) is not effective for the monitoring of metals and can mask concentrations.

Response: Eagle Mine's use of reverse osmosis treatment presents a unique opportunity to provide a continuous measure of the effectiveness of the treatment system, via specific conductivity measurements. Although groundwater rules do not require immediate shutdown of a treatment system when a problem occurs, Eagle has agreed to have this provision in their permit.

Specific conductance measures all of the ions in the discharge from the reverse osmosis unit, metals and non-metals alike. Reverse osmosis treatment involves water passing through a membrane with openings so small that only very small ions (i.e. water size and smaller) can pass. The contaminant ions cannot pass through the membrane unless there is a failure in the membrane system. If that occurs, many ions will pass through the membrane and specific conductance will increase. The "Allowable Operating Range" limit in the permit will be periodically calibrated (based on actual contaminant concentrations in the wastewater prior to reverse osmosis treatment) to determine the specific conductance "shut off" point at which a permit violation could occur.

6. **Comment:** How was the background groundwater quality at the TWIS determined, and where did the data come from?

Response: Rule 2222 (5)(a) of the Part 22 Groundwater Quality Rules of Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA) limits most inorganic substances by only allowing a concentration that is half-way between the background groundwater quality and the concentration at which the site would be a facility as defined by Part 201, Environmental Remediation, of the NREPA, which is the Part 201 generic residential clean-up criteria.

The inorganic substance limit established in a permit is determined by one of the following methods:

- 1) In the absence of site specific background groundwater quality data, a permit limit is established half-way between zero, and the Part 201 generic residential clean-up criteria.

- 2) Using a site specific background groundwater quality value. This is calculated by the sampling and analysis of either upgradient monitoring wells, which are established during the hydrogeological investigation of the site, or monitoring wells that are sampled prior to any discharges at the site. The permit limit would be half-way between the site specific background groundwater quality, and the Part 201 generic residential clean-up criteria. If several wells are to be used in determining background groundwater quality, the arithmetic mean of each well is calculated. The geometric mean of the site is then calculated using the individual arithmetic mean of each well. The background groundwater quality is calculated as the geometric mean plus one standard deviation.

As part of a Schedule of Compliance within the current permit, the facility was required to submit for review and approval a work plan for the installation of additional upgradient and downgradient monitoring wells in the area of the TWIS, install the approved wells, submit a work plan for the establishment of background groundwater quality in the monitoring wells, and collect, analyze and establish the background groundwater quality. This work was completed. In its application for reissuance of the permit for the Eagle Mine, the applicant requested revised groundwater limits for vanadium and pH based on the site specific background concentrations.

The DEQ reviewed the company's data and procedure for calculating the proposed limits contained in the draft permit. In establishing site specific background concentrations, the DEQ used all pre-discharge groundwater monitoring data collected from the groundwater monitoring well network identified in the groundwater discharge permit.

7. Comment: There isn't adequate hydrogeological data to assess the interaction of groundwater and surface water in the area of the TWIS.

Response: In February 2006, a hydrogeological study report was submitted as part of the groundwater discharge permit application for the Eagle Mine. The investigation was conducted to define earth material characteristics and groundwater conditions, and predict groundwater mounding at the discharge site.

The glacial deposit is defined by the bedrock surface, which slopes towards the east/northeast from the discharge area. The observed thickness of the glacial deposits range from 97 to 140 feet, generally increasing in thickness towards the northeast. The unsaturated zone ranges from 75 to 105 feet, and the corresponding thickness of the saturated zone ranges from 12 to 60 feet.

Testing of the aquifer materials was conducted using a single well pump test. The data analyses of both the pumping and recovery period indicated that the aquifer hydraulic conductivity range at the site was 10 to 16 feet per day. Hydraulic conductivity is the ease with which a fluid (usually water) can move through pore spaces.

For the mounding calculations, the discharge flow was set at the design flow for the treatment system. The groundwater mound was predicted to be approximately 22 feet above the static water table surface, which puts the unsaturated thickness of the glacial deposits at greater than 50 feet. Based on the very rapid infiltration rates in the area of the

TWIS, the mound will quickly be assimilated into the aquifer, and will not extend much beyond the discharge area. The discharge will have minimal impact on the groundwater flow direction. This has been demonstrated using the current data from the site, which shows minimal mounding, and an unsaturated thickness of over 70 feet under the TWIS.

Based on this information, and the groundwater flow direction, which, based on five years of data, is east-northeast in the A horizon, and northeast in the B horizon, the calculated velocity of the groundwater in the area of the TWIS is 475 to 766 feet per year. With over 3,000 feet to the area of the seeps, it will take the groundwater 4 to 6 years to reach that distance.

- 8. Comment:** A major dike occurs directly beneath the TWIS. This feature can drain groundwater from the overlying glacial aquifers to the underlying bedrock aquifer.

Response: The bedrock beneath the plains consists mostly of metamorphosed black shale. Also found within the formation are east-west trending volcanic dikes. The dike outcrop on the mine site, which is approximately 2500 feet southwest (up gradient) of the TWIS, is coarse grained. The solid structure that is typically found in igneous and metamorphosed, very fine grained sedimentary rocks results in an extremely limited ability to store or transmit water. Therefore, it is highly unlikely that the upper formation of the bedrock will allow movement of groundwater from the glacial aquifers into the deeper regional bedrock aquifers.

- 9. Comment:** How did the hydrogeological study determine the placement of the monitoring wells?

Response: Development of the groundwater monitoring program at Eagle Mine involved conducting a hydrogeological study of the site in compliance with the requirements of Rules 2221 and 2223. The rules require adequate hydrogeological data, including the determination of the groundwater flow direction.

The result of that study is the groundwater monitoring program which consists of seven upgradient/side gradient wells and eight downgradient monitoring wells. These wells monitor both the A and D horizon aquifers, and the downgradient wells are all within approximately 150 feet of the TWIS.

In addition, Rule 2224(1) of the Part 22 Groundwater Quality Rules of Part 31 of the NREPA requires that groundwater monitoring well locations meet the following criteria:

- 1) They provide a practicable and effective point of measurement.
- 2) They are located on property owned or leased by the discharger, and is under the dischargers control.
- 3) They are *no more than 150 feet from the point of discharge.*

Moreover, Rule 2223(4)(b) requires that if the thickness of the aquifer receiving the discharge is greater than 20 feet, then at least one hydraulically downgradient monitoring well location will contain a cluster well. A cluster well is a monitoring location with at least two wells, with the screens of each well set at different, discrete elevations within one or more aquifers.

10. Comment: Where are waste products from the waste water treatment plant (filter cake/sludge/precipitates) being disposed of?

Response: The Eagle Mine has been disposing both filter press and crystallizer waste streams at the Hickory Meadows Landfill located in Hilbert, WI since March of 2013. Prior to that time they had disposed of the waste at the Marquette County Landfill. The decision to use the current landfill has been based on economics and may change over time.

11. Comment: In the fourth quarter of 2013, Chloride levels in a D-level Monitoring Well near the TDRSA registered more than 600 mg/L for chloride. At the hearing, DEQ staff acknowledged that the chloride exceedances continue to be upward trending "over 700 mg/L." And yet, DEQ has failed to issue a single groundwater quality violation!

Response: Elevated levels of chloride (as well as sodium and specific conductivity) were identified in one of the upgradient background wells for the groundwater discharge permit and one of the compliance wells for the Part 632 mine permit for the last quarter of 2013.

This well location is upgradient of the treated discharge. The reported chloride levels exceed the aesthetic, not health based standard. Salt use at the Eagle Mine site for deicing purposes in winter 2011-12 is being evaluated as the potential cause. As of 4th quarter 2014 the A horizon has concentrations that are lower than experienced in the past. The concentrations in the D horizon have subsided. The concentration levels in the Part 632 compliance well mentioned have also decreased significantly as of the 2nd quarter of 2014, and are trending back towards baseline levels.

The DEQ regulates salt storage at the threshold management quantities of the Part 5 Rules. The controlled application of road salt for deicing purposes is exempt from Part 22 permitting requirements.

Since the majority of salt use for deicing purposes has been eliminated, WRD has not required additional measures. The elevated chloride concentrations in upgradient monitoring well locations are being reviewed by the Office of Oil, Gas, and Minerals (OOGM) staff. The OOGM has the authority under Part 632 to require any necessary response actions with respect to wells within the contact area of the mine site.

- 12. Comment:** Given the 2013 confirmation of uranium in waters at the Eagle Mine facility, more work should be done to determine the source of uranium. [And a limit should be placed in the permit.]

Response: Monitoring of the sump of the development rock storage liner did not detect uranium. Uranium concentrations above drinking water values were detected in the underlying leak detection liner sump, therefore the plausible explanation is a source in that layer. The sump water gets routed to the wastewater treatment system and any uranium is treated by the reverse osmosis system. Reverse osmosis is the treatment technique recommended by EPA for uranium. The permit now contains language requiring notification within 24 hours if uranium levels in the effluent exceed 5 ug/l. In addition, within 7 days, the permit requires a plan for reducing or eliminating the source of uranium. DEQ has the authority to require additional activities to address any exceedance of applicable standards (the drinking water standard is 30 ug/l). See Part I 8 (f) for more detail.

- 13. Comment:** It is a fact that over 42 exceedances of water quality standards at the Eagle mine have been recorded under the original Groundwater Discharge Permit and the mine has not even gone into production yet.

Response: All instances of Eagle Mine groundwater quality exceedance notifications are unrelated to the quality of discharge. The majority of the groundwater quality exceedances were caused by natural variations in groundwater quality that occurred before the Eagle Mine discharge began. One monitoring well location experiencing trace metal impact was redeveloped and reconstructed and groundwater quality has returned to compliance. The DEQ determined that potential additional corrective actions specified in the Compliance Requirements condition of the Permit were not warranted. As detailed in the DEQ response to Comment 6, many of the wells used to determine background conditions were installed as a requirement of the Part 22 permit for this facility. The data collected from them, prior to discharge have been used to calculate background conditions and appropriate groundwater limits in accordance with Rule 2222 5(a).

- 14. Comment:** The Lundin Mining Corporation is being sued in a patent infringement case and the concern is that if they might have to stop using the reverse osmosis system and then would not meet permit limits.

Response: That lawsuit, filed February 28, 2014, was voluntarily withdrawn by the plaintiff on April 12, 2014.

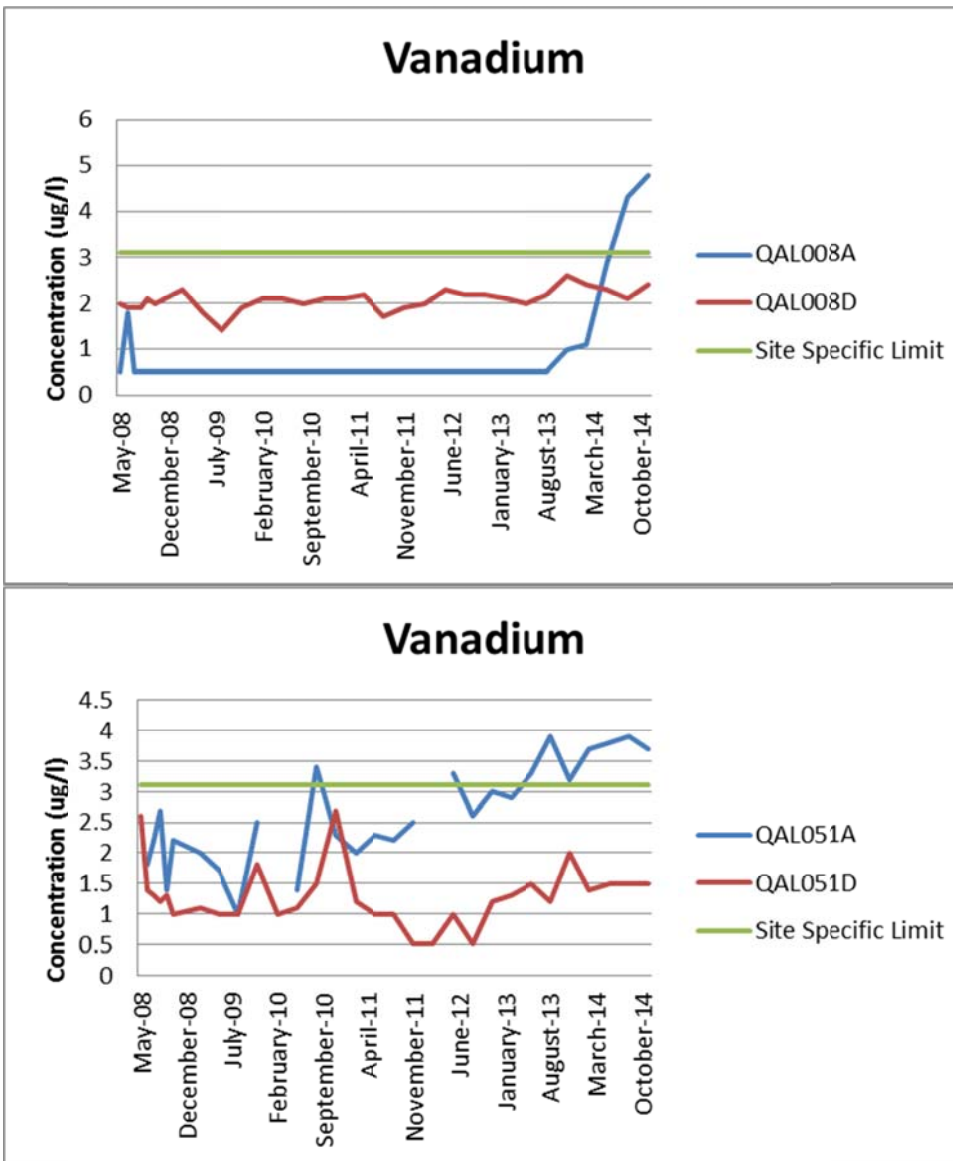
- 15. Comment:** How are hazardous substances in the wastewater monitored for and treated?

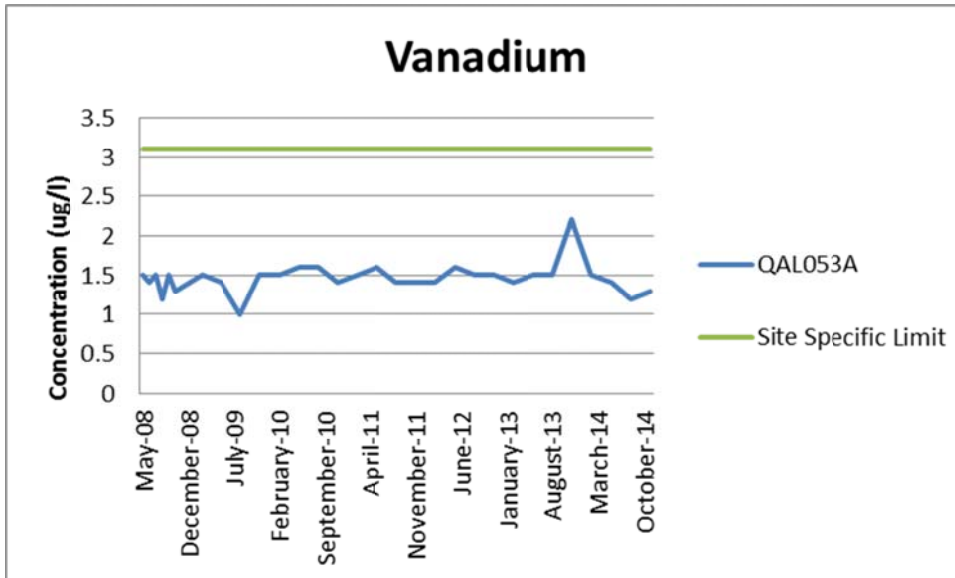
Response: The Part 632 Mining Permit requires an ongoing geochemistry of the rock samples taken as the mine was developed and as mining continues. The effluent monitoring list was based upon that as well as indicator parameters for the use of explosives in the mine. Residues from the use of explosives are monitored by the following parameters: ammonia nitrogen, nitrate nitrogen, lead and aluminum. The wastewater treatment system is capable of treating these compounds and metals (either removing them or meeting limits).

16. Vanadium in Groundwater:

Water quality sampling of the TWIS monitoring wells began in May 2008, and vanadium has consistently been detected in samples from these wells in both baseline and operational monitoring time periods. Vanadium has been detected in the A and D Zone aquifer at several wells both upgradient and downgradient of the TWIS.

Vanadium has never been detected in the Water Treatment Plant effluent. Therefore, the well results indicate that vanadium is naturally occurring in the aquifer. Groundwater mounding may have an influence on the concentration of vanadium near the TWIS. Mounding effects may be increasing vanadium concentrations by increasing saturated thickness of the aquifer, vertical transport from the vadose zone materials, or changing the groundwater flow gradient and redistributing the natural water chemistry. It's also possible that as effluent treated by reverse osmosis comes into chemical balance in the aquifer, it is preferentially leaching vanadium.





Over the past year, vanadium levels in wells QAL008A and QAL051A (within the mound) have increased significantly, while vanadium in QAL053A (outside the mound) have either remained non detect or increased slightly. As a result, the permit now requires installation of a monitoring well cluster downgradient of well QAL008A, and outside of the influence of the mound. The site specific limit for Vanadium will then be applied to the new wells. Monitoring wells QAL008A and QAL051A have been changed to report only for vanadium. The DEQ will continue to review vanadium levels in QAL051A and require any necessary changes to the monitoring program should levels continue to increase. The permit also requires the development of a plan to determine the cause, and if necessary, the correction of the elevated vanadium levels in the area of the TWIS. Vanadium levels in the groundwater are still significantly below the surface water quality standard.

Surface Water Concerns

1. **Comments:** The Eagle Mine needs an NPDES permit.
The permit is authorizing an illegal discharge to surface water.

Response: The EPA responded in February of 2014 to a request for an NPDES permit for this discharge by stating effluent and monitoring well data from the mine do not indicate exceedances of surface water based limits. In addition, they do not think there is evidence of a direct discharge to surface waters.

The permit protects both groundwater and surface water. The Part 22 Groundwater Quality Rules require any discharge within 1,000 feet of a surface water must meet the Water Quality Standards for surface water, [Rule 2224]. Even though the venting location is greater than 3,000 feet from the discharge site, the DEQ requires the mine to treat the wastewater to meet surface water based limits. In doing so the permit is more protective of surface water than the groundwater rules require.

Further, that the DEQ has protected surface water by including limits that are protective of the springs where the discharge vents.

2. **Comments:** Mercury testing has quantification level of 0.5 ug/l (or higher due to sample matrix interference). Has sample matrix interference been anticipated? If not, why not?

How is the mercury limit protective of surface waters which already are impaired by mercury?

Response: Sample matrix interference is generally not anticipated for total mercury. This permit language is boilerplate language and is included for most pollutants. Generally, most labs can achieve the quantification level of 0.5 ug/l for total mercury and in some cases, a lower quantification level.

The mercury effluent limit for this discharge is 2.1 ng/l. After advection and dispersion in the groundwater, this will result in attainment of the Surface Water Quality Standard of 1.3 ng/l in the "springs" that flow into the Salmon Trout River. Since the water entering the springs will meet Water Quality Standards, it will not contribute to violations of that standard. It should be noted that the mercury concentrations in rainwater at Seney, MI averages about 10 ng/l.

3. **Comment:** When effluent limits are compared with surface water standards, I find that Eagle Mine's groundwater allowable limits are consistently being set higher than what's protective of surface water-resulting in regular exceedances that are higher than federal enforceable limits. Raising either effluent or groundwater limits to match (or nearly match) the EPA's MCL value, will certainly not correct this problem, as exceedances are often exceeding the EPA limits!

Response: Attachment I shows allowable limits for protection of surface and ground water. The surface water limits in that table are compliant with the Federal Clean Water Act.

Mine Permit Related Concerns

- 1. Comments:** The characterization of influent wastewater into the Eagle Mine Waste Water Treatment Facility (WWTF) is critical in order to know all of the parameters that must be treated for to meet water quality standards.

The MDEQ has not conducted an independent, comprehensive chemical analysis of a representative sample of the mine cores obtained for the purpose of defining the Eagle ore body. Without this information, the draft permit is unable to properly establish all of the contaminants of concern to adequately regulate the discharge of industrial mine water.

Response: Part 632 puts the burden of proof on the applicant to provide reliable analysis by utilizing qualified consultants and following industry standard procedures. Located in Appendix D of the Part 632 Mine Permit Application is a very detailed geochemical analysis of the Eagle deposit, including, ore, waste rock, and peripheral rock. Descriptions of the predicted water quality pumped from the mine and TDRSA during operations and post-reclamation are also provided. Furthermore, an independent geochemist retained by the DEQ found the Static and Kinetic analysis and modeling to meet industry standards. However, due to subtle uncertainties with modeling, the permittee is required to conduct ongoing characterization of the geochemistry of the ore, waste rock, and overburden that is mined, and peripheral rock that is exposed in the process of mining. Characterization will continue throughout the mining operation to calibrate and adjust the model and predictions of potential generation of acid, dissolved metals, and other related substances that will collectively become the influent to the WWTF.

The mine is required to complete geochemistry during development and production. Development rock samples were collected approximately every 50 meters down the decline and sent to a laboratory for analysis. The type of rock encountered and the sample results were consistent with previous sampling efforts completed in preparation of the application process.

- 2. Comment:** MDEQ has not conducted a comprehensive survey of the hazardous substances used and released in the mine itself such as fuels, explosives, and detonation devices containing toxic chemicals and hazardous substances.

Response: The Eagle Mine has identified explosives used at the mine. Based upon a review of ingredients in the explosives, ammonia, nitrate, and other metals are monitored in the effluent and the groundwater. No other chemicals are used underground in large quantities that would be present in the wastewater.

All fuels stored on site have secondary containment, and lubricants used for maintenance are stored inside the maintenance shop, as required by the Spill Prevention Control and Countermeasures Plan (SPCC). Blasting materials are stored in a secure magazine building and conform to Mine Safety and Health Administration (MSHA) standards.

- 3. Comment:** Without a more comprehensive characterization of the true content of influent water coming into the WWTF, it is uncertain if all potentially hazardous contaminants are being treated, monitored and regulated properly. Some contaminants could be indiscriminately discharged without any notification or permit limit requirements whatsoever. For instance, the previous permit did not include uranium as a parameter, although it was discovered at the Eagle Mine site in April 2013. It is further concerning that the permittee has not provided, or been required to provide, circumstantial evidence whether the actual source of the uranium is the ore body itself or from an offsite location.

Response: A characterization of the geochemistry of the ore and development rock was required to be submitted as part of the mine, reclamation and environmental plan for the Part 632 Mine Permit Application for Eagle Mine. The geochemistry study included results of chemical and physical testing and modeling to predict the potential generation of acid, dissolved metals, and other related substances that will collectively become the influent to the wastewater treatment facility. This characterization will continue throughout the mining operation to calibrate and adjust the model and water quality predictions.

The initial static testing conducted at Phase 1 of the geochemistry study detected elemental uranium in concentrations within range of crustal averages for the rock types identified at Eagle Mine. The more recent static testing results for the development rock confirm the initial results. Aggregate samples from an offsite source stored and used at Eagle Mine were tested and also showed results falling within range of crustal averages. However, since the aggregate is from a source outside the Eagle Mine, the rock type and mineralogy is different than that of the development rock or ore, and uranium may be in a form that dissolves more readily than what was found in the development rock. Regardless of the source of uranium, all rock at Eagle Mine is required to be actively managed so that all water that comes into contact with rock within the contact area must be controlled and treated before being released to the environment.

- 4. Comments:** For the past year, the Superior Watershed Partnership Community Environmental Monitoring Project (SWP CEMP) has been split-sampling water treatment influent at Eagle Mine. SWP CEMP compares their results to Eagle Mine sampling results, and makes the data for each parameter available on its website. Current unregulated influent sampling (i.e. voluntary sampling) could stop at any time. Complete numerical analytical sampling results of *all* potential constituents are critical to understanding the nature of the groundwater that is flowing into the mine at depth and to understanding the performance of the WWTF.

The water from the sump in the underground mine workings is particularly prone to large variations in chemical content. This is due to the method of mining that starts at the bottom of the ore body. The lower reaches of the mine will drain the bedrock groundwater from above, then flow through the ore body after the lower stopes are excavated. This bedrock groundwater will likely contain high dissolved oxygen from the overlying river, wetlands and glacial aquifers. This may result in low pH from the oxidation of the high sulfide mineral

content and create mobile dissolved metals found in the ore body. Add to this, very salty brines that naturally occur at depth in the Precambrian rock. All of this will be going into the WWTF influent. It would be an extraordinary oversight by the State of Michigan if the GWD permit did not require critical sampling of the influent.

Perform and publicize a statistically defensible whole rock analysis from representative core samples of the ore body so that the list in Effluent Limitations (Part 1, GWD permit) can be validated against what is actually in the ore body rock.

Response: Located in Appendix D of the Part 632 Mine Permit Application is a very detailed geochemical analysis of the Eagle deposit, including, ore, waste rock, and peripheral rock. Descriptions of the predicted water quality pumped from the mine and TDRSA during operations and post-reclamation are also provided. Furthermore, a summary of the ongoing geochemical characterization is available in the 2013 Annual Mining and Reclamation Report which will be available on the DEQ website.

- 5. Comment:** Michigan citizens demand to know that Eagle's filtered materials, including uranium, are being properly disposed of, and not creating a groundwater hazard for another community that is receiving the material. Is the presence of uranium, toxic levels of heavy metals and salts in the waste properly classified, and properly disclosed at the waste's disposal point?

Response: Special Permit Condition I.3, in the Part 632 Mine Permit (MP 01 2007), requires the permittee to "characterize, transport, and dispose of materials not exempt from the definition of solid waste in accordance with federal and state solid and hazardous waste regulations. These materials shall be properly stored, labeled, and containerized prior to shipment and disposal or recycling." All material must be characterized prior to transport to a landfill.

- 6. Comment:** Is the disposal of sludge and WWTF wastes by entombing them within the mine, during backfill/cementing operation still an option under consideration? How will groundwater safely impacts (long-term, within saturated backfill materials) be evaluated? Will a decision to use this waste-disposal technique require a groundwater permit?

Response: None of the WWTF wastes will be disposed of in the mine workings.

- 7. Comment:** During the mining operation (both during mine development and drilling) what is the source of water for the mine? Existing groundwater and/or a water supply well? If using a well supply, what's the daily volume?

Response: An existing groundwater supply well provides water to the underground. The daily water requirements vary depending on the activities occurring underground, but on average range from 30,000 – 40,000 gallons per day. The supply and potable water wells have been registered with the State of Michigan since the pumping capacity of the wells is

greater than 70 gpm. As such, they are required to report the total volume of water withdrawn from the well(s) on an annual basis.

8. Comment: A statement made about poor crown pillar stability and generation of acid mine drainage.

Response: The applicant proposes to mine up to Level 383 meters mean sea level. As part of the mining process, cemented back fill will be applied to every other panel mined followed by compacted development rock or imported aggregate in alternate panels. This is a proven method for controlling mine subsidence. However, the DEQ will require the permittee to conduct further field investigations and analysis on crown pillar stability before they proceed beyond Level 327.5 as outlined in Special Permit Condition E 8 of Mining Permit MP 01 2007. In addition, the permittee is required to conduct vigorous monitoring and periodically recalibrate the model to verify validity. If modeling results indicate a problem, the permittee will be required to adjust mining to correct the problem or cease activities. Furthermore, two rock mechanic experts retained by the DEQ both agree this process follows best industry practices.

To address acid mine drainage (AMD) the applicant provided a number of methods to reduce the potential for AMD by mixing limestone with backfill rock, grouting mine workings with cement, and rapidly backfilling the mine workings with water. In addition, the permit contains several precautionary conditions to assure protection of the environment. The mining plan acknowledges there will be some infiltration of water through the crown pillar during mining operations. When mining ceases, this infiltration will be curtailed by the effects of backfilling and re-flooding, as a result, the effects of the remaining crown pillar on surrounding water quality will be no different than those existing before mining, regardless of the crown pillar thickness. Furthermore, an expert mining geochemist retained by the DEQ, concluded the geochemical evaluation performed by the applicant meets industry standards.

9. Comment: The permit allows displacement and relocation of 504,000 gallons per day of underground water, most of which has never been above ground, to the shallow infiltration system. If the area could absorb that much extra water, it wouldn't be covered by wetlands, rivers and seeps. At least a portion of this water will become surface water, not groundwater. There isn't adequate hydrogeological data to assess this groundwater-to-surface water excursion. Regulatory treatment of it as groundwater is not appropriate without a thorough hydrogeological study.

Response: A very detailed hydrogeological study can be found in Volume IIA, Appendix B of the Part 632 Environmental Impact Assessment. Qualified staff reviewed all the information provided and found the conclusions to be defensible. In addition, the permittee is required to conduct vigorous monitoring and periodically recalibrate the model to verify validity. If modeling results indicate a problem, the permittee will be required to adjust the mining operation to correct the problem or cease activities.

Air Quality Related Concerns

- 1. Comment:** Has the direct addition of mercury due to air-born deposition from unfiltered MVAR, been calculated? Was that total subtracted from the Mercury limit to remain protective of groundwater and surface water?

Response: The DEQ Air Quality Division's Response to Comments Summary, dated June 28, 2013, addressed concerns with air-born deposition. From their summary: *although not required for this minor source of air emissions, the potential air deposition impacts from the facility were evaluated. The AQD found that the impacts would not exceed criteria designed to be protective of human and environmental health.*

Table 5 shows that deposition to soils does not cause them to even approach Part 201 criteria (<1%).

Table 5. Health Based Soil Cleanup Criteria and Cumulative Metal Impacts to Soil

Metal	Applicable Part 201 Soil Cleanup Criteria* (ppm)	BLM-RMC** for Metals in Soils (ppm)	10-Year Maximum Soil Concentration (top 1 cm soil) (ppm)	10-Year Maximum Soil Concentration Less than Criteria?
Arsenic	8.6	4	0.02	Yes
Cobalt	9.5	N/A	0.01	Yes
Copper	5800	7	0.19	Yes
Manganese	726	N/A	0.24	Yes
Nickel	100	N/A	0.23	Yes
Selenium	0.4	N/A	6.14E-4	Yes
<p>* This is the lowest of the Direct Contact Criteria, Michigan Natural Resources and Environmental Protection Act (NREPA), PA 451 (324.20120a); the Drinking Water Protection Criteria, NREPA, PA 451 (324.20120a); and the background soil concentration.</p> <p>** Bureau of Land Management Risk Management Criteria, based on protection of lowest criteria of all species listed: American Robin (US Dept. of Interior, 2004)</p>				

ATTACHMENT I

Parameter	Units		# Expected Effluent Quality	5X Expected Effluent Quality	Surface water		ø Effluent Monthly Ave. Limit	ø Effluent Maximum Daily Limit		Background Groundwater Quality	Groundwater 201 Generic Res. Crit.	Part 22 Groundwater Standards		ø Permit Limits Groundwater Monitoring	Limit Basis
					Monthly Ave. WQBEL	Daily Max. WQBEL									
Bicarbonate	mg/l							Report						Report	-----
Biochemical Oxygen Demand	mg/l							Report						-----	-----
Dissolved Oxygen	mg/l							Report						Report	-----
Total Inorganic Nitrogen	mg/l							Report				5		10	Rule 2204(2)(f)
Ammonia Nitrogen	mg/l		2.3					Report			10	5		10	Rule 2204(2)(f)
Nitrate Nitrogen	mg/l		0.03					Report			10	5		10	Rule 2204(2)(f)
Nitrite Nitrogen	mg/l							Report			1	0.5		Report	Rule 2204(2)(f)
pH Minimum	S.U.							6.5						6.5	Surface Water
pH Maximum	S.U.							9		9.7				9.7	SW/Background GW
Total Phosphorus	mg/l		0.034	0.17				Report			63	5		Report	Surface Water
Specific Conductance	umhos/cm							-----						Report	-----
Sulfate	mg/l		1.7	8.5				Report		8.4	250	250		250	Rule 2223(3)
Chloride	mg/l		44	220				Report		8.9	250	250		Report	Section 3109e
Sodium	mg/l		30	150				Report		0.87	230	230		Report	Section 3109e
Aluminum	ug/l		1.9	9.5				Report		49.4	150	150		150	Rule 2204(2)(f)
Antimony	ug/l		1	5	130	2300		Report		2.5	6	5		5	Rule 2222(5)
Arsenic	ug/l		1.7		10		6	10		1.1	10	6		6	Rule 2222(5)
Barium	ug/l		1.4	7	210	1200		Report		13.9	2000	1000		1000	Rule 2222(5)
Beryllium	ug/l		0.05	0.25	2.1	37		Report		0.5	4	3		3	Rule 2222(5)
Boron	ug/l		174		7200	69000		285		50	500	285		285	Rule 2222(5)
Cadmium	ug/l		0.6		2.8		3	5		0.25	5	3		3	Surface Water
Calcium	mg/l							-----		7.3				Report	-----
Chromium	ug/l		0.5	2.5	63	970		Report		3.3	100	52		52	Rule 2222(5)
Cobalt	ug/l		9.2	46	100	740		Report		5	40	23		23	Rule 2222(5)
Copper	ug/l		7.2		7.4	21	10	21		3.3	1000	500		10	Surface Water
Fluoride	ug/l		41					Report			2000	1000		1000	Rule 2204(2)(f)
Iron	ug/l		3.2	16				300			300	300		Report	Rule 2204(2)(f)
Lead	ug/l		0.5	2.5	53	1020		Report		0.5	4	3		3	Rule 2222(5)
Lithium	ug/l		4.2	21	440	1800		Report		6.5	170	88		88	Rule 2222(5)
Magnesium	mg/l							-----		1.3	400	200		Report	-----
Manganese	ug/l		2.4	12	1070	4600		Report		17.6	860	50		50	Rule 2222(3)
Mercury	ug/l		0.0021		0.0013		0.0021	Report		0.00047	2	1		Report	Surface Water
Molybdenum	ug/l		1.1	5.5	3200	58000		Report		6	73	22		22	Rule 2222(5)
Nickel	ug/l		4.9	24.5	32	570		Report		16.7	100	57		57	Rule 2222(5)
Potassium	mg/l		1.2					Report		0.72				Report	-----
Selenium	ug/l		1.3		5		5	25		0.67	50	25		5	Surface Water
Silver	ug/l		0.2		0.3		0.4	17		0.13	34	17		0.4	Surface Water
Strontium	ug/l		95	475	21000	81000		Report			4600	2300		2300	Rule 2222(5)
Thallium	ug/l		0.4	2	3.7	94		Report			2	1		1	Rule 2222(5)
Uranium	ug/l							Report						Report	-----
Vanadium	ug/l		0.3	1.5	27	160		3.1		1.6	4.5	3.1		3.1	Rule 2222(5)
Zinc	ug/l		18	90	140	270		Report		8.2	2400	1200		1200	Rule 2222(5)

ø Permit limitations shown in red

The Expected Effluent Quality (EEQ) is the expected levels for specific parameters that are achieved after wastewater treatment. The parameters are listed in Attachment II of the permit. In conjunction with the Part 22 Groundwater Standards, they provide a further measure of compliance. Condition 8.a) of the draft permit requires additional safeguards by requiring Department notification if a parameter exceeds an EEQ level by five times. The Department will evaluate the data and require additional sampling, action, or treatment if needed.